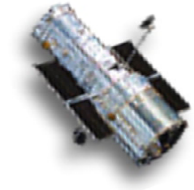
Hubble Facts

HST Program Office

Goddard Space Flight Center
Greenbelt, Maryland 20771



Cosmic Origins Spectrograph (COS)

Essentials of the Instrument:

Installation on HST	**SM4 (~2005)**
Function	**Medium-resol. FUV & NUV spectroscopy with optimized FUV throughput**
__ range	**1150-3200A**
Optical Elements	**Gratings**
Detectors	**16384x1024 FUV X-delay line (2) 1024^2 NUV MAMA**
Field of View	**2.5 arcsec aperture**
Spectral Resolution	**16000-24000 med 2000-3000 low**
Enhancement factor over predecessor instrument (if any)	**COS has > 7x sensitivity gain over STIS in the FUV**
Cost	**$65M**
Current status/health	**Assembled, in Thermal Vac undergoing testing and calibration, awaiting launch**

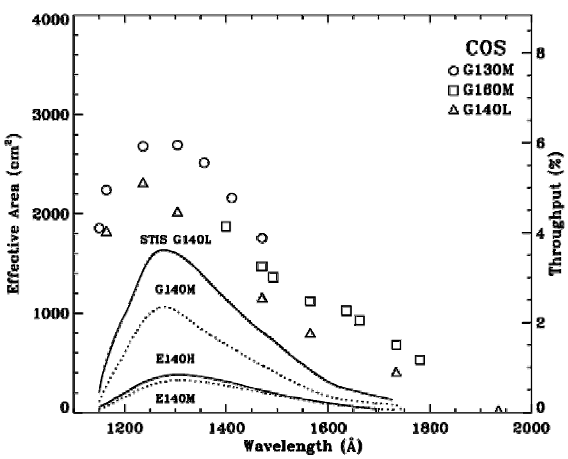
Design and Capabilities of COS

Due to be launched on SM4, COS is a relatively straightforward, primarily point source spectrograph whose design is centered around the one performance niche not addressed by the more all-purpose STIS spectrograph: optimized throughput in the far-ultraviolet (FUV). In addition, COS has near-ultraviolet (NUV) capabilities which for some observing programs will be superior to those of STIS. Although not possessing a wide variety of observing modes, COS will outperform STIS in the key areas for which it was designed, and in many others will provide limited back-up capabilities should the STIS Side 2 electronics (and hence the instrument itself) fail in the future.

In the COS FUV channel, aberrated light entering the 2.5 arcsec instrument aperture strikes one of several holographically-ruled diffraction gratings, which not only disperses the light but removes the HST spherical aberration. With no further reflections the corrected/ dispersed beam falls on a photon-counting cross-delay line detector. The NUV channel requires two mirror reflections ahead of its gratings, and one after, before the dispersed beam enters a NUV-optimized MAMA (multi-anode microchannel array) detector, the last spare MAMA left over from the STIS program.

The table below lists the spectroscopic modes available to COS, and the figure following shows a comparison of the effective areas of COS against those of STIS in the FUV. Note that the COS G140M mode has at least 7 times the effective area of the corresponding STIS medium resolution E140M echelle mode.

Grating	**__ range(A)**	**Angstroms per tilt**	**Resolv. power**
FUV:			
G130M	1150-1450	300	20000-24000
G160M	1405-1775	370	20000-24000
G140L	1230-2050	> 820	2500-3000
NUV:			
G185M	1700-2100	105	16000-20000
G225M	2100-2500	105	20000-24000
G285M	2500-3000	123	20000-24000
G230L	1700-3200	398 or 796	1550-2990



Anticipated Science from COS

Although it is impossible to know in advance what discoveries will be made with a yet-to-be launched instrument—only that it will be well and imaginatively used by successful proposing general observers (GOs)—the scientific hopes of the Instrument Definition Team (IDT) team which is building COS *can* be stated with certainty. The IDT's approved investigation plan addresses three broad areas:

(1) the origins of large-scale structure in the Universe and the intergalactic medium (IGM)
(2) the formation, evolution, and ages of galaxies
(3) the origins of stellar and planetary systems

The first area will rely on COS's superior throughput to obtain gas absorption line spectra along sightlines to hundreds of distant quasars. Such observations with STIS currently comprise a very sparse dataset due to STIS's non-optimized throughput—only a relative handful of useful quasars have been observed. The COS IDT will measure the HeII Gunn-Peterson effect, detailed structure in the Lyman-_ forest, and the D/H ratio and metallicity in primordial intergalactic clouds.

The second goal will also use quasar sightlines to probe the gas in superposed foreground galactic haloes, but will include direct observations of galaxies to constrain evolution models and to measure the production of metal-enriched gas with cosmic time.

Studies of the genesis of stellar and planetary systems will utilize COS's unique UV sensitivities to probe sight-lines toward hot stars in our galaxy which are embedded in dense molecular clouds. COS will also be used to study the atmospheres of the outer planets in our solar system.